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OPERATOR'S MANUAL

PLATE CONDUCTANCE TUBE TESTER
MODEL 1000

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

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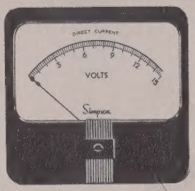

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PLATE CONDUCTANCE TUBE TESTER

MODEL 1000 Operator's Manual

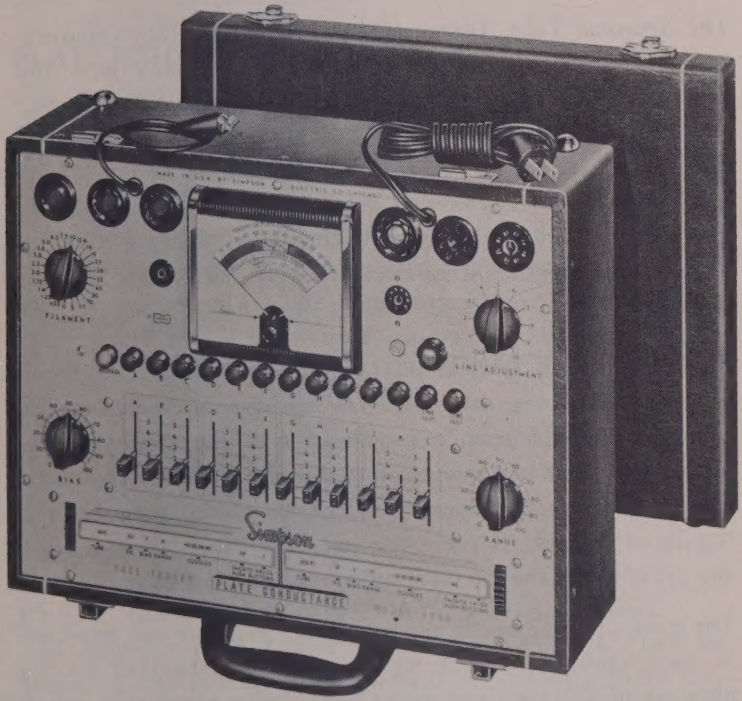

FIGURE 1. THE SIMPSON MODEL 1000
PLATE CONDUCTANCE TUBE TESTER

SIMPSON ELECTRIC COMPANY

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SECTION I

GENERAL DESCRIPTION

The Simpson Tube Tester Model 1000 is a Plate Conductance type instrument which incorporates many new and practical ideas and circuits into its handsome case. It may be used as a portable instrument, or it may be used as a counter model when the top is removed. It has ten tube sockets into which you will place tubes for testing. There is a correct socket for any receiving tube, whether it is old or new, and whether it is standard size, miniature, or subminiature.

PLATE CONDUCTANCE

Plate conductance measurements are dynamic tests which indicate, in each test, a combination of the ability of the cathode to emit electrons, of each grid to affect the plate current in its proper manner, and of the plate to receive the regulated current. If there are no grids (such as in diodes and rectifiers), the measurement is a simple emission test.

The control settings on the roll chart indicate the position of each knob and switch on the panel to establish a combination of voltages and meter sensitivity which will cause correct evaluation of the tube under test. Tube characteristic data is consulted to find the best voltage combination to use for each test. From this, the control settings are determined to place the proper filament, grid bias, screen, suppressor, and plate voltages at the proper tube socket terminals for the tube under test.

The meter sensitivity circuit is adjusted experimentally to obtain the correct indication on each of a group of rated tubes. The control settings indicate information which will use to duplicate these results in your Tube Tester Model 1000.

PLATE RESISTANCE AND TUBE AGE

The defined relationship between the parameters of any amplifier tube states that Amplification Factor is equal to Mutual Conductance times Plate Resistance. The Amplification Factor of any tube is a function of the geometric placement of its elements and their relative areas. This will not change throughout the life of the tube. However, as the tube ages, its Plate Resistance will increase. This increase in Plate Resistance causes the Mutual Conductance to decrease, and a measurement of either parameter will indicate the relative value of the tube. By comparing the measurement to the expected normal value for a new tube of the same type, you can judge the ability of the tube to operate as it was originally intended.

PLATE RESISTANCE AND PLATE CONDUCTANCE

The Simpson Tube Tester Model 1000 measures Plate Resistance through its mathematical reciprocal, Plate Conductance. Thus it provides a dynamic test of the ability of the tube to operate in a circuit application. To provide you with an easy identification of the relative merit of a tube which you test, each measurement indicates a percent of the normal Plate Conductance value which should be present in the tube when it is manufactured.

The control settings which you make according to the chart were established experimentally for each tube so the reading of each tube in a sample group indicates the proper evaluation for that tube. The percentage of Plate Conductance indicated on the meters of several Tube Testers Model 1000 are made to agree with the percent of rated Mutual Conductance measured on each sample tube with a laboratory type Mutual Conductance Bridge. This correlation assures you of proper indications for evaluating all tubes according to standard rating systems when you test them on your Simpson Tube Tester Model 1000.

FAST TESTING

Shorts and leakage resistance are conditions which may develop in a tube during its life and may contribute trouble to the circuits in which the tube is used. The Model 1000 has a circuit which measures the amount of leakage resistance between adjacent tube elements of the tube under test. The sequence of operations in which a tube is tested provides you with this information before you apply operating voltages to the tube elements (except the filament), and prevents you from damaging your tube tester by connecting voltage across a short or a low-resistance circuit.

If there are any paths for inter-element leakage resistance within the tube, the amount of resistance in the leakage is shown on the OHMS scale of the meter. To speed the test, enough elements are separated from all the others to assure all the necessary tests for each tube, but unnecessary extra checks are eliminated. In a diode, for instance only one short test is required; the cathode is separated from the rest of the tube elements, and the ohmmeter will in-

dicate if there is a leakage path either from the cathode to the filament or from the cathode to the plate.

In a pentode, three tests are required; the cathode, screen grid, and plate are each separated (one at a time) from the rest of the elements, and any leakage in either direction from any of these elements will show on the ohmmeter. The resistance value markings on the OHMS scale are black for values above 250K ohms, and are red for 250K and less. This shows any resistance which is below the defined minimum desired value (tube standards) in the red portion of the ohmmeter scale.

A dead short will show full scale pointer deflection, or zero ohms. The circuit which is used to check shorts and leakage allows you to determine which elements are involved in the short and intelligently evaluate the useability or limitations of use of the tube for a circuit application.

PIN SOCKET

Pilot lamps and Christmas tree lamps can be tested quickly in the center of the large 7-pin socket. Insert either screw base or bayonet base lamps in this socket to determine whether they will light. Set the filament switch at a position which will produce the proper voltage for the lamp under test; set toggle A at position O, and toggle G at 1. Press the lamp base into the test socket to see whether it will light.

FUSE

A fuse is mounted in the front panel and connected in series with the primary of the power transformer. If there is any current overload condition which develops in the tube

tester, or which may occur if you apply voltage to a shorted tube, the increased current through the primary of the transformer will burn out the fuse. When this happens, try first to determine why the fuse burned out, and clear the defect before you replace the fuse. Replace with another 1-ampere type 3AG fuse only.

ALL COMPONENTS-ATTACHED TO FRONT PANEL

All the circuit elements and the roll chart of the Model 1000 are attached to the heavy aluminum front panel, and the panel is mounted with ten screws to brackets in the case back. The case top is mounted on the back with separable hinges, so you can easily remove the top to convert the instrument to a counter-top model, or replace the top to convert it back to a portable instrument.

SIZE .. WEIGHT .. CIRCUIT LOAD

The outside measurements of the case, with the top closed, are 15¾ x 11¾ x 6 inches. The instrument weighs 15 pounds. The circuit requires a power source of 105 to 125 volts, 50 or 60 cycles, and the power consumption is 10 watts with no tube under test.

SECTION II

TUBE INFORMATION

The tube types which may be tested are listed on the quick action roll chart and in the table in the back of the manual. This contains all the information necessary to set the controls of the tester for each test which you will make. The charts show control settings in the proper order to help you

perform the following steps:

1. Connect the correct voltage source and value to each tube socket terminal for the tube which you will test.
2. Establish the meter sensitivity to provide a percentage type evaluation of tube condition.
3. Measure the inter-element leakage resistance between adjacent tube elements.
4. Evaluate the relative operating ability of the tube under test.

OBSOLETE AND SELDOM-USED TUBE INFORMATION

All obsolete and seldom-used tube types are listed in the Obsolete and Seldom Used Tube Supplement. All of the receiving tube types currently used are shown on the latest roll chart for the Simpson Model 1000. The roll chart is shortened because the old and seldom used tubes are not listed together with those to which you refer every day. The advantage of shortening the roll chart is to permit faster testing.

NEW TUBE INFORMATION

As new tube types are released, samples will be examined, rated, and tested in the Simpson laboratories. Data for setting the controls of Model 1000 to test these tubes will be established.

AVAILABILITY OF NEW TUBE DATA

SUPPLEMENTS

Data for new types of tubes, not available at the time the roll chart was printed, is prepared in the form of a free supplement. To obtain a copy, write your request to Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill., or in Canada, Bach-Simpson Ltd., London, Ontario.

HOW TO USE YOUR SUPPLEMENT

Only four simple steps are required to add the information shown in the Supplement to your Simpson Model 1000 Roll Chart.

1. Rotate the wheel to locate the place on the Roll Chart where you will add this information under one of the plastic covered windows.
2. Lift the cover out of the window. It snaps out of place.
3. Write the new tube data on the roll chart according to the column headings.
4. When all the new tube data has been listed (and you have checked your work for accuracy), push the plastic cover into the window again. It will snap into place.

NEW ROLL CHARTS

Once each year, Simpson Electric Company will make a new revised roll chart available which will include the original tube data plus the data on the new tube types. To keep your Model 1000 up-to-date, send for the revised roll chart.

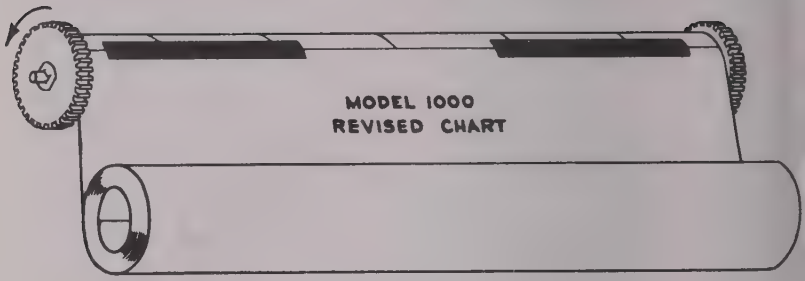
A new roll chart will show all the new tubes which were developed during the previous year. This includes the previous tube list and those shown in the latest Supplement.

HOW TO REPLACE A ROLL CHART

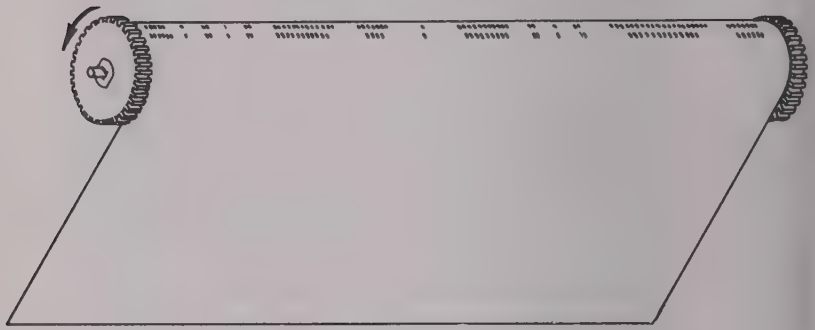
When you replace your roll chart with the new edition, you have the assurance that all the tubes which you wrote in with information from the previous supplement will now be included in their proper positions in the roll chart, as will the added new tubes for which settings were obtained after the last supplement was issued.

To replace a roll chart, remove the panel from the case of the Model 1000. Then remove the four Phillips head screws which hold the mounting brackets to the front panel. When the bracket is removed from the front panel, pull the ends to free both rollers and take the rollers out of the bracket. Unroll the chart from both rollers and remove the tape which holds the chart to each roller.

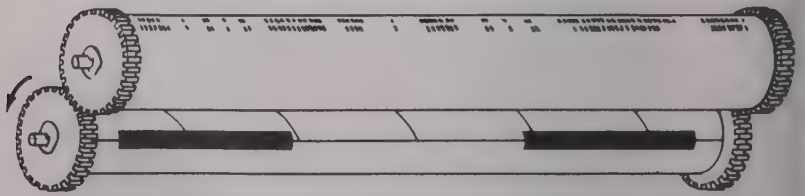
1. Attach the top end of the chart to one roller with some good grade adhesive tape. The printed face of the chart must be away from the roller.
2. Wind the new chart onto the roller smoothly, being sure that it does not wrinkle or bind on the side wheels.
3. Place the other roller under the one on which the chart is wound; then pass the bottom end of the chart through the opening between the rollers and fasten it to the surface of the lower roller with another piece of adhesive tape.



A. Attach Top of New Chart to One Roller.



B. Wind New Chart on Roller.



C. Fasten Bottom of New Chart to Second Roller.

FIGURE 2. REPLACING A ROLL-CHART

4. Pull the paper snugly onto the lower roller when you fasten the end to it.
5. Place the pair of rollers in the mounting bracket with the full roll up, toward the panel mounting.
6. Mount the bracket on the front panel again with the four Phillips head screws, lock-washers and nuts, which were removed at the beginning of the replacement steps.
7. As a final check, see that you have placed the bracket so the printing on the chart shows right side up through the windows, and turn the wheels to roll the chart - through its entire length - and watch for any binding on the wheels or on the paper chart at any operating point.

HOW TO READ YOUR ROLL CHART

Tube sequence on your roll chart follows the same sequence as the number-letter-number designation of tube types. Tube types which have two designations show at the listed point. For instance, a VR-75 is also known as an OA; the roll chart lists it as OA3-VR-75.

Tubes which have letter designations only appear at the end of the list.

For your convenience, the roll chart is set up in two consecutive columns with the first half of the list appearing through the left hand window and the last half through the right hand window.

HOW-TO-DO-IT EXAMPLE

Figure 3 shows the information appearing on the roll chart for a 6AG7 tube. This is a pentode with an octal base and has the following pin connections: filament, 2 and 7; cath-

TUBE	FIL	BIAS	RANGE	TOGGLES	PUSH BUTTONS SHORTS	PUSH BUTTONS VALUE
6AG7	6.3	60	38	015 402 030 011	EFH	H

FIGURE 3. TYPICAL TUBE TESTER DATA ON THE ROLL CHART

ode, 5; control grid, 4; screen grid, 6; suppressor, 1; and plate, 8. Some manufacturers have an internal shield connected to pin 3. As an example of the function of each part of the Model 1000 through the complete tube test, consider what happens in the tube tester as each step of testing is performed on a 6AG7 tube.

1. You have connected the power input and adjusted the LINE ADJUSTMENT control. The toggle switches are all set at 0. These steps are basic for all initial settings, as shown at the beginning of the operating instructions.
2. Set the FILAMENT switch at 6.3. This connects 6.3 volts AC from ground to the #1 contact of each toggle switch in the group A through J.
3. Set the BIAS control at 60. This is a setting which was determined experimentally in the Simpson Laboratory, and will furnish a satisfactory voltage to one of the contacts in the LINE TEST push switch. This voltage will be used as bias voltage for the tube when you evaluate it.
4. Set the RANGE at 38. This is a fine adjustment of the meter sensitivity which was also determined experimentally in the Simpson Laboratory with rated 6AG7 tubes.

It taps a portion of the 3000 ohms to be used in series with the meter movement.

5. Leave the A toggle at 0. This setting grounds the #1 terminal of the octal socket. When you insert the tube later, its suppressor grid will be at ground potential through the connections of the #1 base pin.
6. Set the B toggle at 1. This setting connects the "hot" side of the filament voltage to the #2 terminal of the octal socket. It will connect 6.3 volts to one side of the filament through the #2 base pin when you place the tube in the socket.
7. Set the C toggle at 5. This setting provides an open circuit for the #3 terminal of the octal socket. There is some variation of the use of the #3 base pin from one tube manufacturer to another, but none will have a functional element of a 6AG7 connected through this base pin. An open circuit in the tube tester will assure satisfactory testing of all brands.
8. Set the D toggle at 4. This setting connects the #4 terminal of the octal socket to the switch section in the LINE TEST switch which will furnish grid bias voltage when the LINE TEST push button is pressed. At present, this switch section (in LINE TEST) connects the #4 terminal to ground. When the tube is inserted in the socket, its grid will be connected through base pin #4 to ground. It will be transferred to grid bias after the short tests.
9. Leave the E toggle at 0. This setting connects the #5 terminal of the octal socket to ground. When the tube is

placed in the socket, its cathode will be grounded through the #5 base pin.

10. Set the F toggle at 2. This connects the #6 terminal of the octal socket to the section of the LINE TEST which will furnish screen voltage when you press the LINE TEST switch. At present, this switch section connects the #6 terminal to ground. When you place the tube in the socket, its screen grid will be connected to ground, and will be transferred to screen voltage when you press the LINE TEST button after the short tests.

11. Leave the G toggle at 0. This setting grounds the #7 terminal of the octal socket. When you place the tube in the socket, the filament return will be connected through its #7 base pin to ground. The filament circuit will be complete and the tube filament will heat.

12. Set the H toggle at 3. This setting connects the #8 terminal of the octal socket to the switch section of the LINE TEST switch which will furnish plate voltage when you press the LINE TEST button. At present, this switch section connects the #8 circuit to ground. When you place the tube in the socket, its plate will be connected through the base pin #8 to the circuit which is grounded and will be transferred to plate voltage after the short tests.

13. The I and J toggles are set at 0. These toggles are connected to the #9 and cap lead circuits which are not used for this octal base tube. The normal position for toggle switches in unused circuits is 0, to connect the tube tester circuits to ground. When the 6AG7 tube is

inserted in the socket, these circuits will have no effect because they are not connected through the base pins or in any other way to the tube elements.

14. Set the K toggle at 1. When the K toggle is set in its #1 position, 180 volts is applied to the section of the LINE TEST switch which will connect the plate circuit when the LINE TEST push button is pressed. The K switch also connects 90 volts to another section of the LINE TEST switch, and this section will furnish voltage to the screen circuit when the LINE TEST button is pressed. The third section of the K switch connects 15 volts across the BIAS potentiometer. Since the BIAS control was set at 60, the bias voltage will be correct for obtaining evaluation of the tube.

15. Set the L toggle at 1. This setting of the L toggle places a calibrated shunt value of 14.29 ohms across the meter circuit. The "meter circuit" referred to is the 1000 ohms of the movement in series with the resistance tapped in the RANGE control. The shunt acts as a coarse adjustment of sensitivity. The entire shunted meter circuit is now set so that 30 milliamperes of plate current through the 6AG7 tube will cause a 100% Plate Conductance indication.

16. After all these settings have been completed, place the tube in the Octal socket and allow about 30 seconds for a warm-up period. During this time the filament has 6.3 volts applied across it, and the cathode, control grid, screen, suppressor, and plate all are connected to ground. The meter of the Model 1000 is connected to indicate whether or not the LINE ADJUSTMENT control

is set correctly. Correct its setting, if necessary, to make the meter indicate at the ADJ. LINE mark on the scale. Proceed with the short tests next.

17. Press the push button labelled E. This transfers the connections to the cathode of the tube through the #5 base pin circuit. The leakage resistance, if there is any, between the cathode and any other tube elements, will be in series with the .25 microfarad capacitor, and this circuit will be in parallel with the resistance which is connected between the positive meter terminal and ground. As the leakage resistance reduces in value, the amount of current through the meter will increase, and the pointer will be deflected further to the right on the scale. The meter scale which reads leakage resistance in ohms will indicate what amount of leakage is present between the tube elements. If there is a dead short, the meter current will increase to 200 microamperes, and the pointer will be deflected to full scale to indicate zero ohms of leakage between the cathode and some other element in the tube. If there should be any leakage resistance shown when the E switch is pushed down, the path would probably be either from cathode to heater, or from cathode to control grid. If you wish to determine which of these paths is involved, see the information in Section V, Special Applications.

18. The next short test calls for pressing button F. When the F button is pressed, the E button returns to its up position and the cathode is again connected to ground. The F button now separates the screen grid, through the #6 base pin circuit, from the other elements of the tube

and connects it into the ohmmeter circuit. If there is any leakage resistance, the path will probably be between the screen grid and the control grid, or between the screen grid and the suppressor grid.

19. For the last short test, press button H. When you press this button, the F button returns to its up position and the screen grid is again connected to ground. The H button transfers the plate circuit, through the #8 base pin, to the ohmmeter circuit. If there is any leakage resistance, the path is probably between the plate and the suppressor grid. This completes the short tests, and each element has been checked for any leakage path to the next adjacent element in the tube.

20. If all the short tests indicated that the tube has satisfactory resistance between each of its elements, the value can now be tested. The information under VALUE on the roll chart shows that the H button should be pressed in for this test. In the 6AG7, this happens to be the last button which was pressed for the short test, and it is still pushed in so you can continue. In other tube listings, this will not generally be the case, and another button must be pressed according to the listing under VALUE. When the new button is pressed, the last one used for shorts will be released to its up position.

21. Next, press the LINE TEST button. This switches the control grid, screen, and plate circuits through the #4, #6, and #8 base pin circuits respectively, from ground to the proper tube voltages which were set up with the

K toggle switch and the BIAS control. The tube conducts its normal currents through the same circuits which it will during the tube test which will follow, but the meter is connected to check the LINE ADJUSTMENT control setting. Some high current tubes will load the transformer enough to reduce the voltage outputs of the secondaries. Reset the LINE ADJUSTMENT control for proper meter indication at the ADJ. LINE mark on the scale.

22. Press the TUBE TEST button. This will place the meter circuit (with adjusted sensitivity) in the plate circuit of the tube. The plate current of the tube, which is directly proportional to its Plate Conductance value, will cause the meter to indicate what percent it is of the expected 30 milliamperes which should flow through the plate circuit of a normal new 6AG7 tube. While the tube is being tested, push buttons H, LINE TEST, and TUBE TEST are pressed in. When the test is complete, press the red button labelled RELEASE, and all three of these black buttons will return to their up positions. All voltages except filament are removed from the tube, and all the elements except the "hot" side of the filament are connected to ground.

23. Remove the tube from the socket. Return all toggle switches to 0. If no further testing is to be done, rotate the LINE ADJUSTMENT control to OFF, and the instrument will be disconnected from the line voltage. The meter will indicate this "no power" condition when the pointer rests at the left hand side of the scale.

SECTION III

OPERATING INSTRUCTIONS

The general procedure which you will use to prepare the Model 1000 for use is as follows:

1. Connect the power plug into a source of 105 to 125 volts, 50 or 60 cycle, AC only. Do not attempt to use the Model 1000 on DC.
2. Press the red RELEASE button to release any black buttons which may be pushed.
3. Set all of the twelve toggle switches at 0.
4. Rotate the LINE ADJUSTMENT control clockwise to turn on the tester. Set this control at a position which will cause the meter to indicate its ADJ. LINE mark.

Your Model 1000 is now ready for use. There is no warmup period necessary for the tester.

SETTING THE CHART

Locate the tube type which you are going to test by rotating the roll chart wheel on either end of the chart. If the tube is an obsolete type, find it in the list at the end of this manual. If the tube has more than one section, or if it operates under more than one condition, there will be a separate listing for each section or condition.

When the tube type shows through a plastic window, there is a condensed set of instructions appearing in the next six columns, and these must be used in the indicated sequence in order to protect the tube and the tester. The four col-

umns which are headed FILAMENT, BIAS, RANGE, and TOGGLES show you how to set these controls in the Model 1000 to arrange the proper circuit for a tube before you place the tube in its socket. The last two columns indicate that you press PUSH BUTTONS to check for SHORTS (or inter-element leakage) and to prepare the tube circuit for the final value test.

After you have pressed the VALUE button, or buttons, there are two more steps which do not show on the roll chart because they are the same for every tube tested: press the LINE TEST push button to connect the proper voltages to all tube elements and correct the LINE ADJUSTMENT control if the meter indication has changed from its ADJ. LINE mark; then press the TUBE TEST button and read the relative value of the tube's operating characteristics on the meter.

FILAMENT SWITCH

The setting of the FILAMENT switch according to the information on the chart will tap the amount of filament voltage shown at the switch position. The BIAS control setting shows where to place the index of the knob to duplicate satisfactory results obtained experimentally. The setting for the RANGE control also shows where the index of the knob needs to point in order to duplicate experimental results.

TOGGLE SWITCH SELECTION

All 12 TOGGLE switches have numbered positions, and the proper position for each toggle is specified by number in the chart listing. Each of the 12 digits which show under

TOGGLES on the chart indicate a switch position. The switches appear in the same sequence, from left to right, as the digits on the chart.

The first digit is the position for the A toggle, the second digit for the B toggle, and so on across the group of 12 toggle switches. Start each arrangement of toggle switch settings by pulling all the levers to set all switches at 0. Then set each toggle to the numbered position indicated by its digit on the tube chart.

SUB MINIATURE ORIENTATION

All tubes are properly oriented when they fit in their sockets, except for sub-miniature rectangular types. To connect the elements of these tubes to the proper tube socket terminals, hold the tube so that its red index mark corresponds to the red dot on the socket; then insert each lead next to the red dot. Use as many socket terminals as required for the leads coming out the base of the tube.

OHMMETER CIRCUIT

After the tube filament has had an opportunity to warm up, press the buttons listed on the chart under the heading SHORTS. Press these down one at a time and read the resistance on the OHMS scale of the meter.

When you press down any of these push buttons, you transfer one tube element to one side of the ohmmeter circuit. All the other tube elements are connected to ground, which is the other side of the ohmmeter circuit. If the meter indicates a value of 250K ohms or more for each test, the tube should be satisfactory for use according to defined

commercial standards. However, if there is a dead short, with zero ohms, or a leakage resistance with less than 250K ohms of resistance, the indication will be in the red marked area of the dial, indicating a condition which is not normally acceptable.

There are some cases when a leakage resistance with a relatively low value may be used in a circuit which has low impedance; on the other hand, a very high value of leakage resistance may cause trouble in high impedance applications. It is possible for you to identify which elements are involved in a leakage circuit if you need to evaluate the tube usability with these special considerations. See Section VI, Special Applications, for this information. Do not test any unsatisfactory tube beyond this point.

CONTROL-GRID, SCREEN-GRID, PLATE VOLTAGE

When the short tests are finished, and the tube is considered satisfactory for further checking, press the push button, or buttons, listed under VALUE on the chart, and then press the LINE TEST button. Up to this point, the filament of the tube has had voltage applied across it, but all the other elements have been connected to ground. When you press the LINE TEST button, you apply control grid, screen grid, and plate voltage to the tube and it begins to conduct current.

The amount of current does not register on the meter, but it will load the transformer the same as it will during the value test which follows, so you can reset the LINE ADJUSTMENT control when it is necessary to correct for the loading effect.

APPLY TUBE TEST

Press the TUBE TEST button, and read the value of tube quality of the meter. If the tube is a diode or rectifier, read the arc marked DIODES GOOD. When the emission is below standard or there are poor element connections the meter pointer will indicate a value to the left (below) the GOOD area. If the emission and element connections are satisfactory, so all the elements perform their proper functions, the pointer will indicate in the GOOD area.

Any tube other than a diode or rectifier will indicate a percentage of its rated PLATE CONDUCTANCE on the upper arc of the meter. To help you quickly judge the tube quality, there is a scale with colored sections which are related to the percent of Plate Conductance. If the meter indicates that the Plate Conductance is 85% or more of the amount it should be, the pointer will indicate in the heavy green area labelled GOOD. Readings from 70% to 85% measure FAIR in the light green area.

The light red area marked WEAK corresponds to readings from 55% to 70%. Readings below 55% show in the heavy red area labelled REPLACE. These indications will assist you and your customers to decide whether or not a tube will be placed back into service, or if it must be replaced with a new tube.

AFTER EACH TEST

After you complete the tube test, press the red RELEASE push button to restore all the black push buttons to their up position. If there is a second section or condition to be tested in the same tube, this will be shown in the chart

listing for the tube. Leave the tube in the socket, change the controls to conform to the second listing, and test it.

At the end of the last test for any tube, press the red push button, and remove the tube from its socket. When the tube is out of the socket, pull all the toggle switches down to their 0 positions and proceed with the next tube test.

OFF POSITION

After all tubes have been tested, turn off the Model 1000 by rotating the control knob fully counterclockwise, to its OFF position. The meter pointer will move back to the left hand side of the scale. The instrument can be left in this condition safely while it is not in use.

SET TESTER UP FIRST

The following table summarizes the operating instructions in step-by-step form. Be careful to observe the proper sequence when testing a tube to prevent damage to either the tube or the tester. Do not place any tube in a socket until the FILAMENT switch, BIAS and RANGE controls, and TOGGLE switches have all been sent to the positions indicated in the chart for the tube which you are testing.

TABLE 1. STEP-BY-STEP OPERATING INSTRUCTIONS

1. Connect the power plug to a source of 105 to 125 volts, 50 or 60 cycles AC. Use AC only for the Model 1000.
2. Press in the red RELEASE button at the left hand side of the panel to restore all black push buttons to up positions. Set all the toggle switches at 0.
3. Turn the LINE ADJUSTMENT control to the right to

turn the instrument on. Set the control for a meter indication at ADJ. LINE.

4. Turn the roll chart with either wheel until the settings for the tube show through a plastic window. If there is more than a single test shown for the tube, use the first listing for the first test. Find obsolete and seldom-used tubes in the list at the back of the manual.
5. Set the FILAMENT, BIAS, and RANGE controls and all twelve TOGGLE switches in the positions shown in the chart listing.
6. Plug the tube into the socket which matches its base. If the rectangular sub-miniature socket is used, turn the tube so its red index matches the red dot. Insert its leads in each successive socket terminal, beginning at the red dot. If there is a top or side cap on the tube, connect the cap clip to it. If there are two caps on the tube, use the special cap lead for the second cap connection. Notes on the chart will tell how to do this.
7. Allow a warm-up period, to heat the filament of the tube.
8. Press the push buttons listed under SHORTS on the chart. Press one at a time, and read each leakage resistance or short indication on the OHMS scale of the meter. Discard any tube which shows too low a resistance on any of these tests.
9. Press the push button (or buttons) listed on the chart under VALUE.
10. Press the LINE TEST push button. Reset the LINE ADJUSTMENT control if necessary to make the meter read

at ADJ. LINE.

11. Press the TUBE TEST push button. Read the quality indication on the meter. Read the DIODES GOOD arc for diodes and rectifiers, or the colored areas and percent markings for all other tubes.

12. Press the red RELEASE push button at the left hand side of the panel. All the black push buttons will restore to their up positions.

13. If the tube has additional sections or conditions to be tested, leave the tube in the socket and repeat the above operations, beginning with step 5. The FILAMENT switch position does not change for any additional tests on the same tube.

14. After the last section of the tube has been tested and the red RELEASE button has been pressed, remove the tube from the socket. Return all TOGGLE switches to 0.

15. Proceed with testing a new tube, beginning with step 3. Or if there are no more tubes to be tested, rotate the LINE ADJUSTMENT control to its OFF position. A slide switch at the end of the potentiometer opens the primary circuit of the power transformer and turns the Model 1000 off.

SECTION IV

THEORY OF OPERATION

100% METER POINTER DEFLECTION

The Simpson Tube Tester Model 1000 is an instrument

which provides normal operating voltages to all the elements of a tube under test, and then establishes a meter in the plate circuit of the tube to indicate the tube condition according to the regulated plate current. The meter sensitivity is varied so that a tube which is operating correctly, according to manufacturer's specifications, deflects the pointer to the 100% indication on the meter. Other tube conditions will cause proportional deflection of the pointer to indicate the relative quality existing in the tube.

Many new tubes will show indications above 100% and this is normal. Tube characteristics are maintained on a tolerance basis, and many new tubes will have more than the specified normal value of Plate Conductance. In the same way, there will be many new tubes which will have indications below 100%, and these represent the tubes which the manufacturer allowed to be shipped, even though they have values below the normal level, but within the tolerance range.

BLACK VALUES ARE SATISFACTORY

In general, the leakage resistance between tube elements in a vacuum tube should be at least 250,000 ohms. In the Model 1000, each short test consists of separating one element at a time from all the others in the tube and measuring the resistance between the isolated element and all the others. The resistance is indicated on the OHMS scale of the meter. Satisfactory values are marked in black, and unsatisfactory values are marked in red.

The short tests listed will be sufficient to indicate any unsatisfactory resistance conditions in any tube under test.

Further checks are required if it is desirable to know which tube elements are involved in the short or leakage. See Section VI, Special Applications, for further instructions.

ROTARY CONTROLS

There are four rotary controls on the front panel of the Model 1000. Figure 1 shows the location of each of these controls. The FILAMENT switch is a rotary type with 24 positions. Twenty-three positions are marked for the amount of voltage which the switch will select from the power transformer.

These voltages include all the values required for the tube filaments of tubes which will be tested. They range from zero to 117 volts. The 24th position of the FILAMENT switch is labelled "S". This switch position is used when checking cold cathode tubes such as an OZ4, in which the plate voltage of the Model 1000 is not sufficient to initiate conduction across the tube. The 117 volts available from the FILAMENT switch is added in series with the plate voltage of 180 volts to furnish enough voltage to start conduction in the tube.

A 3K resistor, added in series with this circuit, is a current limiting resistor which protects the tube once it starts to conduct.

LINE ADJUSTMENT CONTROL

The LINE ADJUSTMENT control is a continuously variable potentiometer in series with the primary of the power transformer. The transformer is wound so that it will produce the correct secondary voltages when 100 volts is

applied across the primary windings. The LINE ADJUSTMENT control drops the excess line voltage to permit exactly 100 volts to be applied across the transformer.

When the control is properly adjusted, the meter will indicate at the ADJ. LINE mark on the dial. The meter circuit is arranged and calibrated as an A.C. voltmeter, and measures the voltage output of the 25 volt tap on the filament secondary of the power transformer. There is a slide switch which is actuated at the full counterclockwise position of the LINE ADJUSTMENT control. When the control knob is set fully counter-clockwise, the switch is open and the instrument is turned off. Clockwise rotation will close the switch and turn the instrument on.

BIAS CONTROL

The BIAS control in the lower left hand corner of the front panel is a continuously variable potentiometer with a snap switch actuated in its counterclockwise position. The switch opens or closes a short around a 400 ohm current limiting resistor which is used when testing high current rectifiers.

The switch action requires the first seven divisions of knob rotation. The switch shorts across the resistor when the BIAS control is set at or above 7 divisions. When the knob is set at 0, the switch is open. The rest of the positions indicate the relative value of bias voltage which is tapped for each tube application when there is a control grid in the tube.

The bias voltage at 7 divisions is zero, and the bias voltage at full clockwise rotation can be 5, 15, or 45 volts.

The amount of bias voltage across the entire potentiometer depends on the position of toggle switch K. The voltage which will be used as bias for testing the tube is connected to one section of the LINE TEST switch; it is not furnished to the tube circuit until the LINE TEST switch is pushed later.

RANGE CONTROL

The RANGE control at the lower right hand corner of the front panel is a continuously variable potentiometer which is in series with the meter circuit and is a vernier adjustment of the meter sensitivity. The settings shown on the chart are based on experimental results, and cause the meter to indicate a percent of Plate Conductance present in each of a group of sample tubes corresponding to the percent of Mutual Conductance with the same tube indicated under controlled laboratory conditions.

TOGGLE SWITCHES

There are twelve toggle switches across the bottom of the front panel, and these are identified with letters (A through L). Each switch except K has six positions (0 through 5). Switches A through J are single section switches which connect socket terminals to the proper voltage sources for the tube which is to be tested. In the 0 position, each switch contacts ground; in the 1 position it contacts filament voltage; in the 2 position it contacts screen voltage; in the 3 position it contacts plate voltage; in the 4 position it contacts grid bias voltage; and in the 5 position it furnishes an open circuit.

Switch A connects the voltage source for all the socket terminals #1; switch B connects the voltage source for all #2 terminals; and this system follows in sequence so that switch I connects the #9 terminal of the noval socket and the center of the loktal socket. The J switch connects the voltage source for the cap lead which comes out the top of the front panel between the 5- and 6-pin sockets.

K SWITCH

Toggle switch K is a three section switch which has four positions (0 through 3). A combination of voltages is selected with this switch to furnish the grid bias, screen, and plate voltages for each application. The bias voltage is applied across the BIAS potentiometer, and a proportional part of this total available voltage can then be tapped through the panel marking system with the control knob. This system contributes excellent accuracy of bias voltage values for the settings of the tube tester.

The screen voltage is applied through the LINE TEST push switch directly to the screen circuit of the tube under test. The plate voltage is applied through the LINE TEST switch to the tube's plate circuit.

In its 0 position, the K switch selects 45 volts for bias, 90 volts for screen, and 180 volts for plate voltages. In the 1 position, the K switch selects 15 volts for bias, with the screen at 90 and the plate at 180 volts. In the 2 position, the K switch selects 15 volts bias, 45 volts screen, and 90 volts plate voltage. And in the 3 position, the K switch selects a bias voltage of 5 volts, with a screen voltage of 15 and a plate of 45.

Plate voltages used for diode tests are the same as the grid bias voltages listed above for positions of toggle K, and a 24,000 ohm resistor is placed in series with the tube circuit as a current limiting resistor.

L SWITCH

Toggle switch L is a single section switch which selects a shunt value to place across the meter movement as a course sensitivity adjustment. This switch uses all six positions (0 through 5) marked on the panel. The positions marked 0, 1, 2, 3 and 4 furnish a variety of sensitivities such that high current tubes will use the zero position and low current tubes will use the #4 position of this L switch.

The #5 position of the L switch connects the bias voltage from the K switch through the 24,000 ohm resistor to be used as plate voltage for light duty diode tests.

PUSH BUTTONS

There is a group of fourteen push-switches located in a row above the toggle switches. The red push button at the left hand side is labelled "RELEASE", and is used to restore all the black push buttons to their up position at the end of a tube test.

Buttons A through J transfer the connections of the tube elements for short testing and for the value test. A mechanical catch system under the push button switches is arranged so push switches A through J release when any other switch in the same group (A through J) is pressed. During the short tests, each element is checked separately when one of this group of push buttons is pressed. When the second element is tested, the push button for the first

is automatically released to its up position.

After the short tests are complete, the push button switch which controls the plate circuit of the tube under test is pressed in and left for the line test and tube test.

When the meter polarity needs to be changed for special applications, the K push button will be listed under VALUE on the chart. Press the K push button when it is required by the test. This will not release any other push switches.

LINE TEST BUTTON

The LINE TEST button applies operating voltages to the tube elements and places the meter in the circuit to indicate that the LINE ADJUSTMENT control is properly set at just the instant the tube goes into its value test. If there has been a change of line voltage since the short tests began, or if the tube passes enough current to load the transformer and reduce secondary voltages, this indication, just before the value test, will show the results and the control should be corrected to provide the exact voltages which are required for proper value indications.

TUBE TEST BUTTON

The final TUBE TEST opens the plate circuit to the tube and places the adjusted meter circuit in series to measure the plate current through the tube when the TUBE TEST push button is pressed. There will be either three or four push buttons pressed in while the tube is evaluated: the plate button for the tube (listed under VALUE in the chart), the LINE TEST button, and the TUBE TEST button: the fourth will be the K button, when it is specified under

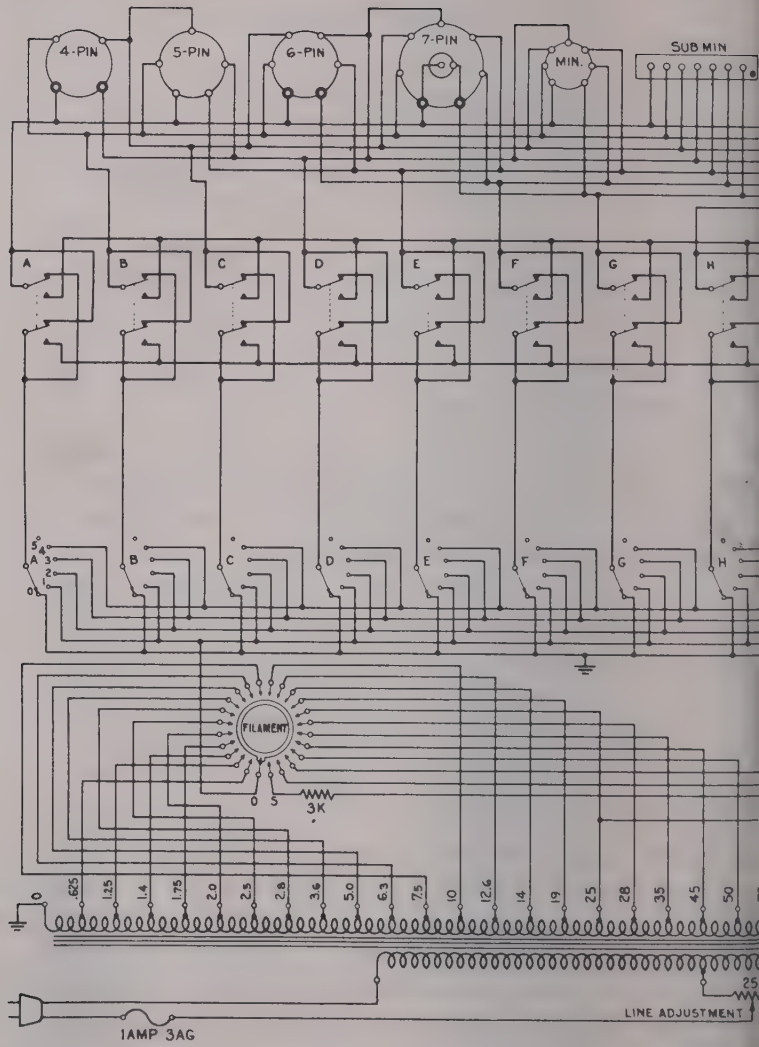
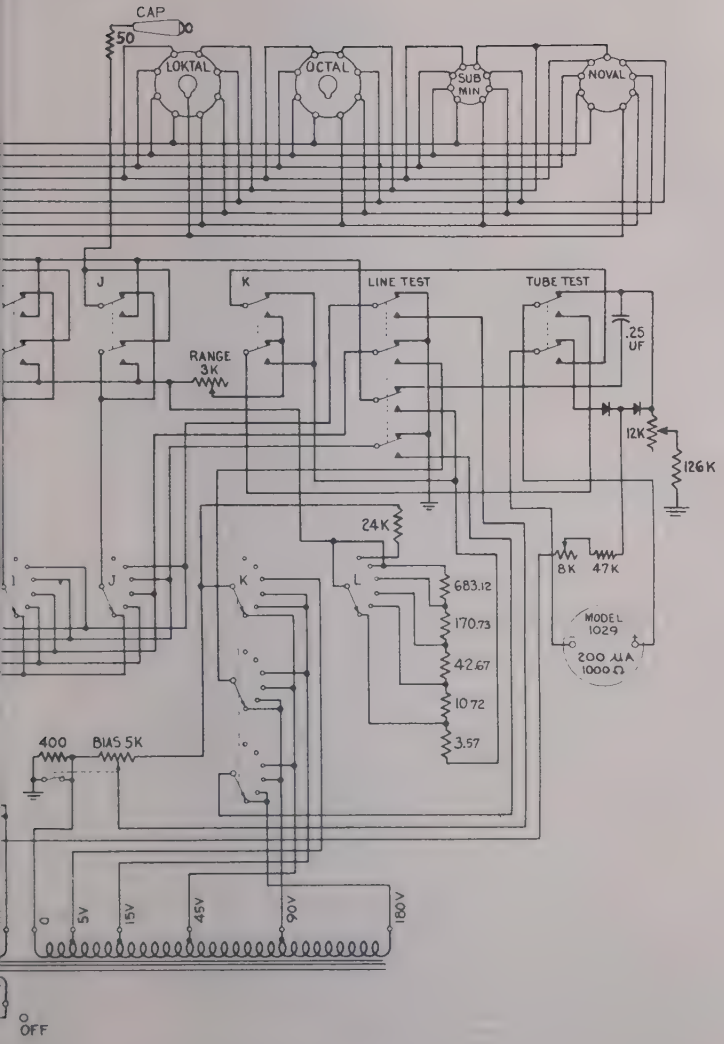


FIGURE 4. SCHEMATIC DIAGRAM,



MPSON TUBE TESTER MODEL 1000

VALUE in the chart.

After the test is complete, press the red RELEASE button at the left hand side of this row, and all the other push switches will return to their up position.

A THROUGH J SWITCHES ARE TRANSFERS

Each push switch in the group from A through J operates as a transfer switch for one tube element according to its base pin number. The A switch controls connections to all #1 socket terminals; the B switch to all the #2 socket terminals; and in sequence through the I switch for the #9 terminal of the noval socket and the center of the loktal socket. The J switch controls the connections to the cap lead.

SPECIAL CONNECTIONS

There are several socket terminal connections which do not follow the standard numbering system (clockwise from an index, looking at the bottom). In the Model 1000, these special connections are made as follows. The pilot light socket in the center of the 7-pin socket is connected to the #1 and #7 circuits. The center of the loktal socket is connected to the #9 circuit.

The sub-miniature rectangular socket has no numbers assigned to its seven terminals. In the Model 1000, these terminals are connected as if they were numbered from 7 through 1, beginning at the red index dot.

SECTION V

MAINTENANCE

There are very few parts in the tube tester which are likely to be damaged or will wear out over a long period of use. However, there are a few precautions which you should observe in order to assure continued satisfactory operation of the unit.

K TOGGLE SWITCH

The K toggle switch is a three section rotary type switch with the actuating lever extending out the side of the wheel. Only four positions are used for the setting of this switch, while each of the other 11 similar switches uses six positions. There is a mechanical stop in the K switch which allows you to use positions 0, 1, 2, and 3, but prevents you from pushing the lever arm beyond the #3 position. Do not attempt to force the K toggle switch beyond its #3 position, or the switch will probably be damaged so that you will have to replace it.

TUBE SOCKET TERMINALS

In a long period of time, the terminals of the tube sockets may accumulate a dirty film on the inside contact surfaces which will interfere with continuity to the inserted base pins of the tubes being tested. If you suspect this condition, spray or flow a little contact cleaner through the socket terminals to eliminate the film and restore the necessary continuity.

FUSE FAILURE

When the primary winding of the power transformer becomes overloaded, the fuse in series with the power input will blow to protect the tube tester from any further damage. There are three possible reasons for fuse failure: 1. It can indicate that you have set the tube tester controls incorrectly; 2. It can indicate that you have applied voltages to shorted elements; 3. It can indicate that a short circuit has developed within the circuits of the tube tester.

If the fault is a short circuit in the tester, use the schematic diagram, figure 4, to locate and eliminate the source of trouble.

The fuse is a 1 ampere type 3AG. It is mounted in a fuse holder through the front panel. To remove it, unscrew the cap of the holder and the fuse will lift out with the cap.

Replace this with another 1 ampere type 3AG fuse. Do not use a higher ampere rating fuse for this replacement.

TROUBLESHOOTING YOUR ROLL CHART

SPRINGS

There is a small flat spring inside the base of the roll chart mounting bracket. This spring presses up against the bottom of one gear wheel to hold the chart in any position in which you set it. If the spring has been bent, it may interfere with fast action in your rotation of the wheels to find tube information, or it may have been pressed down so that it does not place any tension against the wheel and the chart does not tend to stay in a position to which it has been set. Reset the spring as necessary to obtain the slight

tension against the wheel.

CENTER SHAFT CLIPS

Each roller is assembled on a center shaft. The tube sets into recesses in the inside wheel faces. The wheels are fastened on the shaft with a speed-nut clip at each end of the assembly. If the clips slip out on the center shaft, the entire assembly will become loose, and there will be added bearing pressure in the bracket mounting. If this should happen, tighten the assembly by forcing each clip in against the outer wheel face.

SECTION VI

SPECIAL APPLICATIONS

TESTING PILOT LAMPS AND CHRISTMAS TREE LAMPS

The center of the large 7-pin socket has a receptacle into which you can insert any lamp which has a miniature base. Whether the lamp has a screw base or a bayonet base, it has a center contact on the end of the base, and the other contact is the shell around the side of the base.

When the lamp is placed in the receptacle, the center contact will connect to the center of the receptacle, and the shell of the lamp base will contact the metal wall around the receptacle. The center of the receptacle is connected to the #1 terminal of the tube socket.

Set toggle switch "A" at 0 to connect ground potential of the tube tester. The metal wall of the receptacle is con-

nected to the #7 terminal of the tube socket. Set toggle switch "G" at 1 to connect filament voltage. Set the FILAMENT switch at the rated voltage for the lamp to be tested. Set the LINE ADJUSTMENT control to a position which will cause the meter to indicate at the ADJ. LINE mark on the scale. Insert the lamp in the receptacle and it will light to its normal intensity if it is a good lamp.

DETERMINING TUBE ELEMENTS INVOLVED IN A LEAKAGE PATH

The recommended short tests will indicate that there are, or are not, satisfactory resistances between the elements of any tube under test. To simplify these tests and shorten the time required for testing each tube, the system recommends isolation of alternate elements in the tube. This will indicate when a leakage or short exists, but will not furnish sufficient information to show you which elements are involved.

Most indications show the combined resistance through two parallel paths; for instance, when the cathode is separated from the rest of the tube elements, any leakage resistance between the cathode and filament is in parallel with any leakage resistance between the cathode and the next element in the tube--the plate in a diode or the control grid in any other tube.

In some circuit applications, a lower-than-normal resistance between cathode and control grid may allow satisfactory service, while in another application, it may be necessary to have more than 250,000 ohms between these elements. Do not use a tube which has low resistance

between the cathode and filament.

To determine which of two possible paths has the leakage resistance, increase the number of elements isolated for the short tests. The path can then be identified through a process of elimination.

Push buttons A through J are each identified with any element of any tube through the base arrangement of the tube. Consult a tube manual to determine which base pin is associated with each element in the tube. Then the push buttons can be associated with the elements. Pin #1 uses the A button, #2 uses the B button, #3 uses the C button, #4 uses the D button, #5 uses the E button, #6 uses the F button, #7 uses the G button, #8 uses the H button, #9 uses the I button, and the cap lead uses the J button.

Through this association, the elements which are separated for the standard short tests can be identified. If the other elements (except the filaments) are added to the ones which are specified for the tube, the second element involved in a leakage path will be identified by having a reading similar to that of the first element which was checked.

As an example, suppose that the meter indicates 100K when the E button is pressed while testing the 6AG7 as discussed in Section II. The E button is in the circuit for the #5 base pin. Referring to the base arrangement, the #5 base pin is the cathode connection. So the 100K resistance could be between cathode and filament, or between cathode and control grid. The filament can not be separated, but the control grid can be separated for a short test. The

control grid is connected to pin #4, and the push button for the #4 circuit is D. Press the D button and read the OHMS scale of the meter again. If the 100K reading appears again in this test, the leakage resistance is between the cathode and the control grid. If the reading shows in the black markings on this test, the leakage is between the filament and the cathode.

Use this system to help identify which elements are involved in an inter-element leakage when the information will aid you to evaluate a tube for a special application. You will know the internal condition of the tube and can judge the circuit results and establish the necessary precautions intelligently.

SELECTING TUBES FOR APPLICATION IN MATCHED CIRCUITS

The dynamic Plate Conductance tests which you make with your Simpson Tube Tester Model 1000 will furnish indications which you may use to match the characteristics of several tubes of the same type for circuit applications which require balanced action. The same tests can be used to match two sections within one dual-type tube. Examples could be push-pull amplifier circuits in the amplifiers of an oscilloscope, and two sections of an electronic bridge network.

Test each tube or section in the normal manner, and record the interelement leakage resistances and percent of Plate Conductance for each one. Match these results in order to select tubes which have similar characteristics.

DEVELOPING SETTINGS FOR NEW TUBES

The systematic circuit layout of the Simpson Tube Tester Model 1000 makes it possible for you to create your own tube testing data for new tubes before this information is available to you through the supplements and revised roll charts which you will be able to obtain from Simpson Electric Company. All that is required is a set of tube characteristic data, the base arrangement, and several known good sample tubes.

Here are the steps which you will require for all tubes except diodes and rectifiers:

1. Set the FILAMENT switch to the position which taps the required filament voltage. If there are two optional filament voltages and corresponding contact arrangements, choose the higher voltage and observe the series filament connections when setting the toggle switches in step 2.

2. Set toggle switches A through J to positions which will connect the proper source of voltage to each circuit element for normal operation. Toggles A through I set connections for base pins 1 through 9 respectively, and toggle J sets the connection for the cap lead.

   The positions of the switches are as follows: 0 is ground; 1 is filament; 2 is screen; 3 is plate; 4 is control grid; and 5 is open.

NOTE

To set up a series filament connection for higher voltage in an optional-filament tube, connect one end

of the filament to ground (toggle switch position 0), the center tap to an open circuit (toggle switch position 5), and the other end of the filament to the filament voltage source (toggle switch position 1).

NOTE

For tubes which have special double-ended connections for any elements, connect only one of the pin circuits to the voltage source, and connect the other pin circuit to an open circuit (toggle switch position 5).

3. Consult the tube characteristic data and set the K toggle switch at a position which furnishes the maximum plate and screen voltages within the tube ratings. The K toggle will furnish these operating voltages; in the 0 and 1 positions, the plate is 180 volts and the screen is 90 volts; in the 2 position, the plate is 90 volts and the screen is 45 volts; and in the 3 position, the plate is 45 volts and the screen is 15 volts. If the highest voltages are to be used (180 for plate and 90 for screen), choose position 1 temporarily, rather than position 0. If this needs to be in position 0, it will be shown when you perform step 9.
4. Set the BIAS control at 7, the RANGE control at about 50, and the L toggle at 0.
5. Insert the tube in the socket and allow it to warm up. Then apply the short tests. Consult the base diagram of the tube and select the base pin numbers which correspond to alternate elements, beginning with the

cathode it is indirectly heated, or with the next element if the tube has a filamentary type cathode. Translate these base pin numbers into push switch designations to determine which switches to press for the short tests. For instance, if an element to be checked is connected to the #4 base pin, press push button D for the short test for that element.

6. If the tube has a satisfactory leakage resistance between each adjacent pair of elements, proceed with the tube test. Otherwise, do not proceed with the test on the faulty tube, or the tube tester may be damaged.

7. Consult the base diagram for the tube to select the base pin number for its plate. Translate this into a push switch and toggle designation. The push switch is the one which you will list for the VALUE column. Press this push button. The toggle should be the one which you had set to position 3 in step 2 above. Change the toggle setting to 5 and remove the tube tester from its case for the next step.

8. Connect a DC current meter from the #5 terminal of the plate toggle switch to the #3 terminal of the same toggle switch. See Figure 5 for an indication of the location for these meter lead connections. The #5 terminal of the toggle switch is the one nearest the bottom of the panel.

   Connect the negative meter lead to this terminal. The second terminal above that is the #3 terminal to which you will connect the positive meter lead. Use a current meter such as you can obtain with the circuits of

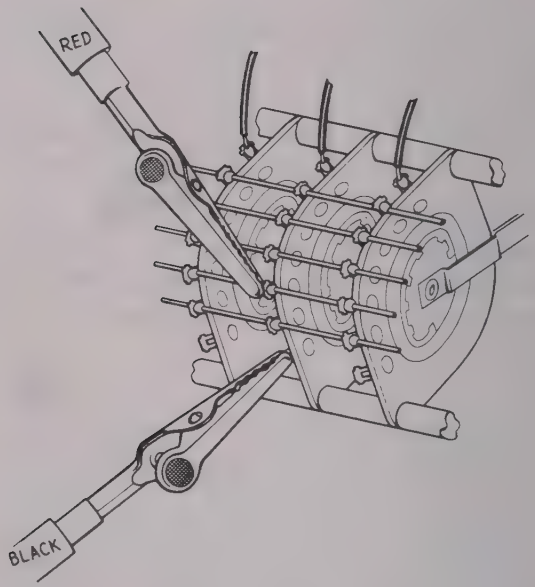


FIGURE 5. METER CONNECTIONS FOR MEASURING PLATE CURRENT

a Simpson Model 260, Model 262, or Model 269, and set the range to indicate the maximum value of plate current shown on the tube characteristics.

9. Press the LINE TEST button. Observe the current meter and rotate the BIAS control to obtain the plate current which is listed in tube characterisitics.

   If the K toggle is in its #1 position and you cannot bring the plate current up to the proper amount with the BIAS control, return the BIAS control to 7 and

then set the K toggle at 0. Advance the BIAS control to obtain the proper plate current.

When you have a combination setting which will give you enough plate current, list the settings for the K toggle and the BIAS control under the proper headings for tube information.

10. Remove the current meter leads from the toggle switch. Press the red RELEASE button to restore the VALUE button and the LINE TEST button to their up positions. Return the toggle switch for the plate circuit to its #3 position. Put the tube tester back into its case.

11. Press the VALUE button and the LINE TEST button again. Reset the LINE ADJUSTMENT control if necessary for a meter indication at ADJ. LINE.

12. Press the TUBE TEST button. Use the L toggle switch and the RANGE control as coarse and fine adjustments, respectively, to obtain a 100% indication on the meter. The meter pointer deflection will increase as the L toggle setting increases through 0, 1, 2, and 3, to 4. Do not use position 5 of the L toggle for this application. Meter pointer deflection will also increase as the RANGE control setting is increased (turn clockwise).

13. Record all the control and switch settings and the percent indications for the first tube. Then repeat the test on all other available good tubes of the same type. If necessary, revise the setting of the RANGE

control to obtain an average indication nearest 100% for the group of sample tubes.

Record the final settings of all controls as tube test information on the roll chart. This will provide relative indications of the characteristics of the same type of tube which you can use until correct information reaches you from the factory. Your reference level is the average for whatever characteristics existed in your sample group. The correct tube chart information which you receive from the factory will have a reference level which has been established with standard rated tubes of the same type.

SECTION VII

PARTS LIST

Description	Use	Simpson Part Number
Special cap lead assembly	2nd cap circuit	0-008458
Meter assembly		15-302200
Transformer, power		1-115060
Case assembly		10-890162
Potentiometer, 3000 ohms, 5%	RANGE	1-114715
Potentiometer, 5000 ohms, 5% w/switch	BIAS	1-114716
Potentiometer, 250 ohms, 25 watts, OFF position	LINE ADJUSTMENT	1-114722
Rheostat, 8000 ohms, 20%	Calibration	1-113618
Rheostat, 12000 ohms, 20%	Calibration	1-115091
Resistor, 50 ohms	Cap lead current limiter	1-115350

PARTS LIST

Resistor, 3000 ohms, 5%, 10 watts	Cold cathode current limiter	1-112635
Resistor, 400 ohms, 5%, 10 watts	Rectifier current limiter	1-112637
Resistor, 126K, 1%, ½ watt	Meter to ground	1-115092
Resistor, 47K, 1%, ½ watt	Line test sens.	1-114898
Resistor, 24K, 5%, 1 watt	Diode test sens.	1-111694
Resistor, bobbin, 3.57 ohms	Meter shunt	0-008252
Resistor, bobbin, 10.72 ohms	Meter shunt	0-008256
Resistor, bobbin, 42.67 ohms	Meter shunt	0-008257
Resistor, bobbin, 170.73 ohms	Meter shunt	0-008259
Resistor, bobbin, 683.12 ohms	Meter shunt	0-008297
Capacitor, 0.25 μf, 20%, 200 v	SHORTS circuit	1-114718
Rectifier, full wave type	Meter circuit	1-111807
Switch, 24 position rotary	FILAMENT	1-114723
Switch assembly, 14 section push type	Push button switches	1-114673
Switch assembly, 6 contact non-short	Toggle A through J	0-008844
Switch assembly, 6 contact shorting	Toggle L	0-008845
Toggle switch assembly, complete	All toggles mounted	0-008843
Knob, red push button	RELEASE button	1-115058
Knob, black	Push and toggle switches	1-112547
Knob, black	Rotary controls	1-114728
Cover, clear plastic	Roll chart window	1-114825
Roll chart assembly, complete	Bracket, rolls, etc.	10-890160
Cap lead assembly	"J" circuit	0-008459

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

**ARIZONA, PHOENIX
Metercraft, Inc.
3304 N. 24th Street
States: Arizona
Phone: CRestwood 9-5287

CALIFORNIA, LOS ANGELES
Quality Electric Company
3700 South Broadway
States: Southern California below Fresno and Arizona
Phone: ADams 2-4201

CALIFORNIA, SAN FRANCISCO
Pacific Electrical Instrument Lab.
111 Main Street
States: Northern California above Fresno and Nevada
Phone: GArfield 1-7185

**CANADA
Bach-Simpson Ltd.
1255 Brydges Street, P.O. Box 484, London, Ontario, Canada
Phone: GLadstone 1-9490

COLORADO, DENVER
Meter-Master Instrument Service
2379 S. Downing Street
States: Wyoming, Utah, Colorado, and New Mexico
Phone: RAce 2-8670

*Parts Depots only; no repairs.
**Repair Stations only; no resale of parts.
(All other stations repair instruments and sell repair parts)

CONNECTICUT, NEW HAVEN
Kaufman Instrument Labs, Inc.
810 Dixwell Avenue
States: Connecticut
Phone: SPruce 6-7201

FLORIDA, ORLANDO
Electro Tech Corp.
307 - 27th Street
States: Florida
Phone: GArden 3-5589

GEORGIA, ATLANTA
Electro-Tech Equipment
690 Murphy Ave., S.W.
States: Alabama, Georgia, Carolina and Tennessee
Phone: PLaza 3-4128

**ILLINOIS, CHICAGO
Simpson Electric Company
5200 W. Kinzie Street
Phone: EStebrook 9-1121

*ILLINOIS, CHICAGO
Pacific Indicator Company
5217 W. Madison Street
States: Chicago, Wisconsin and Indiana
Phone: COlumbus 1-1330

**KANSAS, KANSAS CITY
Sturtz Instrument Co.
4705 Mission Road
States: Kansas
Phone: STarline 1-4711

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LOUISIANA, NEW ORLEANS
Industrial Instrument Works
3328 Magazine Street
States: Arkansas, Mississippi and Louisiana
Phone: TWinbrook 5-5621

MASSACHUSETTS, CAMBRIDGE
Alvin C. Mancib Company
363 Walden Street
States: Vermont, New Hampshire, Massachusetts, Rhode Island and Maine
Phone: UNiversity 4-2494

MICHIGAN, DETROIT
Ram Meter, Inc.
1100 Hilton Road, Ferndale
States: Michigan
Phone: LIncoln 7-1000

MINNESOTA, MINNEAPOLIS
Instrumentation Services
917 Plymouth Avenue
States: Minnesota, North and South Dakota
Phone: KEllogg 7-5411

MISSOURI, ST. LOUIS
Scherrer Instruments
5449 Delmar Blvd.
States: Illinois below Peoria, Iowa, Missouri
Phone: FOrest 7-9800

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NEW YORK, BUFFALO
Electrical Instrument Labs
932 Hertel Avenue
States: New York State except Metropolitan New York
Phone: EXport 2-2726

NEW YORK, NEW YORK 7
Simpson Instrument Service Corporation
27 Park Place
States: Metropolitan New York and New Jersey above Trenton
Phone: BArclay 7-4977

**NEW YORK, SYRACUSE
Syracuse Instrument Lab
4895 South Avenue, Box 96
Phone: HYatt 2-1651

OHIO, CLEVELAND
Weschler Electric Company
4250 W. 130th Street
States: Ohio and Kentucky
Phone: CLearwater 1-4609

**OKLAHOMA, TULSA
Tri-State Instrument Lab
2216 N. Sheridan Road
States: Oklahoma
Phone: TEmple 5-1890

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**OREGON, PORTLAND
Industrial Instrument Repair Lab.
1910 N. Killingsworth St.
States: Oregon
Phone: BElmont 4-6683

PENNSYLVANIA, PHILADELPHIA
Sunshine Scientific Instrument
1810 Grant Avenue
States: Pennsylvania, Maryland, New Jersey below Trenton, Delaware
Phone: ORchard 3-5600

TEXAS, DALLAS
Nelson Electronic Engineering Co., Inc.
6329 Gaston Avenue
States: Texas
Phone: TAylor 4-2626

**TEXAS, HOUSTON
Nelson Electronic Engineering Co., Inc.
3615 Gulf Freeway
Phone: CApitol 8-2835

VIRGINIA, FALLS CHURCH
United Instrument Lab., Inc.
110 Jefferson Street
States: Washington, D.C., West Virginia, Virginia
Phone: JEfferson 2-1212

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**Repair Stations only, no resale of parts.
(All other stations repair instruments and sell repair parts)

WASHINGTON, SEATTLE
The Instrument Lab., Inc.
934 Elliott Avenue West
States: Oregon, Washington, Idaho and Montana
Phone: ATwater 3-5850

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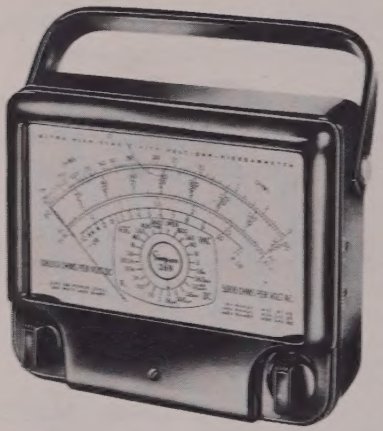
MODEL 269

AC-DC Volt-Ohm-Microammeter
100,000 Ohms per Volt DC
5,000 Ohms per Volt AC



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Complete with test leads and operator's manual.

Self shielded movement

Can replace VTVM's for many voltage and resistance checks.

VOLTAGE RANGES
DC: 1.6v; 8v; 40v; 160v; 400v; 1600v; 4000v.
AC: 3v; 8v; 40v; 160v; 800v.
AF: 3v; 8v; 40v; 160v.
DB (1MW-600Ω): −12 to +45.5 db in four ranges.

CURRENT RANGES
DC: 0-16ua; 0-160ua; 0-1.6ma; 0-16ma; 0-160ma; 0-1.6 amps; 0-16 amps.

RESISTANCE RANGES
0-2KΩ (18Ω center); 0-20KΩ (180Ω center); 0-200KΩ (1800Ω center);
0-2 megΩ (18KΩ center); 0-20 megΩ (180KΩ center);
0-200 megΩ (1.8megΩ center).

ACCURACIES
DC volts ±3% F.S.; AC volts ±5% F.S.; DC resistance ±3% of arc length.

Size: 7 15/16" x 6" x 2 15/16" . . . **Weight:** 4 lbs., Shpg. wt. 6 lbs.

WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

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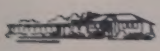

LAC DU FLAMBEAU PLANT
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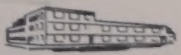

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